

CLAIMS

What is claimed is:

- 1 29. A method for providing a description of a signal received from a lightning event, the signal
2 having been modified by travel through a medium, the method comprising:
3 determining a plurality of frequency domain components of the signal;
4 determining a plurality of adjusted magnitudes for a multiplicity of the frequency domain
5 components of the plurality; and
6 providing a description of a time domain signal corresponding to at least the plurality of
7 adjusted magnitudes for the multiplicity of frequency domain components.
- 1 30. The method of claim 29 further comprising:
2 determining whether the signal has traveled over terrain; and
3 determining the plurality of adjusted magnitudes in accordance with whether the signal
4 has traveled over terrain.
- 1 31. The method of claim 30 wherein adjusted magnitudes are determined in accordance with a
2 filter function of frequency and conductivity when it is determined that the signal has traveled
3 over terrain.
- 1 32. The method of claim 29 wherein applied adjustments mitigate an effect of conductivity of
2 terrain.
- 1 33. The method of claim 29 wherein the description comprises a peak amplitude.
- 1 34. The method of claim 29 wherein the description comprises a rise time.
- 1 35. The method of claim 29 wherein adjusted magnitudes are determined in accordance with a
2 first function of frequency and conductivity.
- 1 36. The method of claim 35 wherein the method further comprises:
2 determining conductivity as a second function of frequency; and

3 determining an adjusted magnitude in accordance with the first function and a result of
4 the second function.

1 37. The method of claim 36 wherein determining the conductivity comprises:
2 determining a magnitude breakpoint frequency in the multiplicity of frequency domain
3 components; and
4 determining the conductivity in accordance with the breakpoint frequency.

1 38. The method of claim 37 wherein determining the conductivity in accordance with the
2 breakpoint frequency comprises computing a square root of the break point frequency.

1 39. The method of claim 29 wherein:
2 a. the method further comprises determining a plurality of adjusted phases for the
3 multiplicity of frequency domain components of the plurality; and
4 b. providing the description comprises providing the description of the time domain
5 signal further corresponding to at least the plurality of adjusted phases for the multiplicity of
6 frequency domain components.

1 40. A memory device comprising indicia of instructions for a processor to perform the method of
2 any of claims 29 through 39.

1 41. A sensor that provides a description of a signal received from a lightning event, the signal
2 having been modified by travel through a medium, the sensor comprising:
3 a processor; and
4 a memory coupled to the processor, the memory comprising indicia of instructions
5 enabling the processor to determine a plurality of frequency domain components of the signal,
6 determine a plurality of adjusted magnitudes for a multiplicity of the frequency domain
7 components of the plurality, and provide a description of a time domain signal corresponding to
8 at least the plurality of adjusted magnitudes for the multiplicity of frequency domain
9 components.

- 1 42. The sensor of claim 41 wherein the instructions further enable the processor to determine
2 whether the signal has traveled over terrain, and determine the plurality of adjusted magnitudes
3 in accordance with whether the signal has traveled over terrain.
- 1 43. The sensor of claim 42 wherein adjusted magnitudes are determined in accordance with a
2 filter function of frequency and conductivity when it is determined that the signal has traveled
3 over terrain.
- 1 44. The sensor of claim 41 wherein applied adjustments mitigate an effect of conductivity of
2 terrain.
- 1 45. The sensor of claim 41 wherein the description comprises a peak amplitude.
- 1 46. The sensor of claim 41 wherein the description comprises a rise time.
- 1 47. The sensor of claim 41 wherein the instructions further enable the processor to determine
2 each adjusted magnitude in accordance with a first function of frequency and conductivity.
- 1 48. The sensor of claim 47 wherein the instructions further enable the processor to determine
2 conductivity as a second function of frequency, and determine an adjusted magnitude in
3 accordance with the first function and a result of the second function.
- 1 49. The sensor of claim 48 wherein the instructions further enable the processor to determine a
2 magnitude breakpoint frequency in the multiplicity of frequency domain components, and
3 determine the conductivity in accordance with the breakpoint frequency.
- 1 50. The sensor of claim 49 wherein the instructions further enable the processor to compute a
2 square root of the break point frequency.
- 1 51. The sensor of claim 41 wherein the instructions further enable the processor to determine a
2 plurality of adjusted phases for the multiplicity of frequency domain components of the plurality,

3 and to provide the description of the time domain signal further corresponding to at least the
4 plurality of adjusted phases for the multiplicity of frequency domain components.

1 52. A circuit for use in a lightning sensor, the lightning sensor for providing a description of a
2 signal received from a lightning event, the signal having been modified by travel through a
3 medium, the circuit comprising:
4 a processor; and
5 a memory coupled to the processor, the memory comprising indicia of instructions
6 enabling the processor to determine a plurality of frequency domain components of the signal,
7 and determine a plurality of adjusted magnitudes for a multiplicity of the frequency domain
8 components of the plurality, thereby enabling the sensor to provide a description of a time
9 domain signal corresponding to at least the plurality of adjusted magnitudes for the multiplicity
10 of frequency domain components.

1 53. The circuit of claim 52 wherein the instructions further enable the processor to determine
2 whether the signal has traveled over terrain, and determine the plurality of adjusted magnitudes
3 in accordance with whether the signal has traveled over terrain.

1 54. The circuit of claim 53 wherein adjusted magnitudes are determined in accordance with a
2 filter function of frequency and conductivity when it is determined that the signal has traveled
3 over terrain.

1 55. The circuit of claim 52 wherein applied adjustments mitigate an effect of conductivity of
2 terrain.

1 56. The circuit of claim 52 wherein the description comprises a peak amplitude.

1 57. The circuit of claim 52 wherein the description comprises a rise time.

1 58. The circuit of claim 52 wherein the instructions further enable the processor to determine
2 each adjusted magnitude in accordance with a first function of frequency and conductivity.

1 59. The circuit of claim 58 wherein the instructions further enable the processor to determine
2 conductivity as a second function of frequency, and determine an adjusted magnitude in
3 accordance with the first function and a result of the second function.

1 60. The circuit of claim 59 wherein the instructions further enable the processor to determine a
2 magnitude breakpoint frequency in the multiplicity of frequency domain components, and
3 determine the conductivity in accordance with the breakpoint frequency.

1 61. The circuit of claim 60 wherein the instructions further enable the processor to compute a
2 square root of the break point frequency.

1 62. The circuit of claim 52 wherein the instructions further enable the processor to determine a
2 plurality of adjusted phases for the multiplicity of frequency domain components of the plurality,
3 and to provide the description of the time domain signal further corresponding to at least the
4 plurality of adjusted phases for the multiplicity of frequency domain components.

1 63. A lightning detection system that provides an estimated location of a lightning event, the
2 system comprising:

3 a. an analyzer that provides the estimated location of the lightning event in accordance
4 with a plurality of messages; and

5 b. a plurality of sensors that provide a message of the plurality respectively comprising
6 sensor identification and a time of detecting the lightning event; each sensor comprising:

7 (1) a receiver that receives an event and provides a first time-domain signal in
8 response to the lightning event;

9 (2) a waveshaping circuit that determines a frequency component of the first
10 signal, adjusts at least one of the magnitude and phase of the component to provide an adjusted
11 component, and determines a second time-domain signal in accordance with the adjusted
12 component; and

13 (3) a transmitter that provides the message in accordance with the second time-
14 domain signal.

1 64. The system of claim 63 wherein the waveshaping circuit further determines a plurality of
2 frequency components of the first signal, adjusts a multiplicity of the frequency components of
3 the plurality to provide a plurality of adjusted components. and determines a second time-domain
4 signal in accordance with the plurality of adjusted components.

1 65. The system of claim 64 wherein the waveshaping circuit further adjusts frequency
2 components of the multiplicity to provide a series of adjusted components having magnitudes
3 that exhibit in log frequency domain a slope that is inversely proportional to frequency.

1 66. The system of claim 65 wherein the slope in log frequency is $1/f$ where f is frequency in
2 Hertz.

1 67. The system of claim 64 wherein each component of the multiplicity corresponds to a
2 respective frequency above 50 KHz.

1 68. The system of claim 64 wherein each component of the multiplicity corresponds to a
2 respective frequency above 100 KHz.